Models, Modelling, Metaphors and Metaphorical Thinking - From an Educational Philosophical View

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Nina Bonderup Dohn *

Abstract: *»Modelle, Modellierung, Metaphern und metaphorisches Denken - Aus einer pädagogisch-philosophischen Sicht«*. In this contribution, I present my view of models and metaphors within educational research, very broadly speaking. I start out by articulating my educational philosophical perspective as a form of applied philosophy. Inspired by Ricœur, I then define models as "instruments for configuration and reconfiguration". I argue that metaphors and metaphorical thinking are more basic than models and modelling. The former can guide reasoning in a holistic, heuristic manner. The latter can be used analytically to develop the initial metaphorical similarity into articulated analogies. Models and metaphors may be deployed explicitly and consciously but may also (mis)lead cognition through implicit structuring of thinking. I proceed to give examples of the roles which models and metaphors have within different areas of (research in) education, teaching, and learning. One example is the explicit development of design patterns; another is implicit adherence to either an acquisition metaphor or a participation metaphor of learning. Towards the end, I provide tentative answers to three questions posed by my discussion pair, Willard McCarty, concerning 1) computer modelling, 2) open-endedness of models and metaphors, and 3) situated knowledge and relativism.

Keywords: Models, metaphors, epistemology, learning, educational research, design patterns.

1. Introduction

In this article, I shall present my view of models and metaphors within educational research, very broadly speaking. I shall start out by articulating the perspective and background from which I come and the type of questions I focus on. I explicate my understanding of "model" and "metaphor" – and their relationship – and proceed to give examples of the roles which models and metaphors have within different areas of (research in) education, teaching, and learning. I thus take on the following questions:

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- Do you have a preferred definition of models and/or modelling?
- What is the relation between modelling and reasoning?
- What is the role of analogy and similarity in modelling?
- Do you see modelling as a core method in your discipline?

The perspective and background from which I approach models and metaphors is that of educational philosophy, with a particular focus on epistemological questions concerning knowledge and learning. I practice educational philosophy as a form of "applied philosophy", *i.e.* a discipline, where philosophy is put to use within other areas of education research[1]. I bridge epistemology and learning theory, and do so both theoretically and in terms of practical pedagogy. It is thus a defining characteristic of my research that I combine philosophical inquiry into the nature and requirements of knowledge and education with the conduct and analysis of empirical investigations of learning practices inside and outside of schools. On this background, querying the significance of models and metaphors as formal and informal reasoning strategies for me concretizes to questions like the following: What role do models, modelling, metaphors and metaphorical thinking play in (research on) educational design? What role do I as an educational philosopher see them as playing in teaching and learning, and in the *conceptualization* of teaching and learning – in research and practice? What role do I as an epistemologist understand them as having in reasoning and cognition in general?

2. Basic Definition of Models – Preferred Definition

Ricœur, following Hesse, defines a model as "an instrument of redescription", explaining that "the model is essentially a heuristic instrument that seeks, by means of fiction, to break down an inadequate interpretation and to lay the way for a new, more adequate interpretation" (Ricœur 2003 [1975], 283). He further claims that models have metaphoric reference, in that, by use of the model "Things themselves are 'seen as'; they are identified… with the descriptive character of the model." (Ricœur 2003 [1975], 287). This fundamental relationship between models and metaphors, that models draw on a metaphorical "seeing as", is central to my approach to models. However, I follow Lakoff and Johnson (1999, 1980; Johnson 1987) in viewing metaphorical understanding, not the linguistic expression of it, as primary. Furthermore, I take models to be grounded in metaphorical "seeing as", rather than the other way around, and in contrast to the position – suggested by Ricœur with Black (Ricœur 2003

[1] I have explicated my view of 'applied philosophy' as a 'philosophizing with' in Dohn (2011b). A collection of articles articulating and engaging in this type of applied philosophy is found in my Professorial Thesis (Habilitation in German) (Dohn 2017).

[1975], 283) – that metaphors and models play analogous roles, each within its own field (poetics versus science): On my view, metaphorical "seeing as" is a holistic coupling of fields where the one is understood "in the light of" the other and where the implicitly postulated resemblance between the fields is as much a result of the "seeing as" as it is a prerequisite to it. Models expand and articulate this holistic coupling into more concrete form, clarifying the resemblance, at once aligning and restricting it. This is done by explicating the resemblance as an analogy between the fields where traits from the one correspond (most often one-to-one) to traits within the other. Models thus – for good and bad – lead thinking along a much more clearly demarcated route than the holistic imaginative metaphorical coupling itself. "Modelling" refers to the process of explicating the holistic coupling as analogy. Paradigmatic examples of models are material or digital configurations/visualizations, mental schematizations, scripts, and theoretical representations. As they are grounded in metaphorical "seeing as" understood not as (first and foremost) linguistic expression, but as understanding of the one field "in the light" or "through the lens" of the other, the basis of at least the former three are not necessarily linguistically articulated. Their explication into analogy will obviously involve linguistic representation and further conceptualization, though. Nonetheless, Ricœur's characterization of models as "redescription" accords too much significance to this linguistic articulation process. Likewise, material and digital models typically provide epistemic affordances through the visualization of relationships between aspects, but Ricœur's terminology easily misleads one to neglect visualization and its potentials. Defining models as "instruments for configuration and reconfiguration" appears more appropriate.

This constitutes my answer to the first question above, i.e. of a preferred definition of models and/or modelling. It also indicates my overall take on the second and third questions, i.e. which role I as an epistemologist understand models, modelling, metaphors and metaphorical thinking to have in reasoning and cognition, and what role analogy and similarity play in modelling: Metaphors and metaphorical thinking are more basic than models and modelling. They can guide reasoning in a holistic, heuristic manner, where the similarity postulated by the metaphor is to some extent configured by the metaphor itself. Models can be used analytically to gain insights based on developing the initial metaphorical similarity into articulated analogies. To this I should add that models and metaphors may be deployed explicitly and consciously but may also (mis)lead cognition through implicit structuring of thinking.

In the following, I turn to the more specific questions of the role of models and metaphors within education and educational research, including educational design. Space limitations bar an exhaustive overview, but I shall provide some indicative examples, which between them illustrate both explicit and implicit uses.

3. Role of Models and Metaphors in (Research on) Educational Design

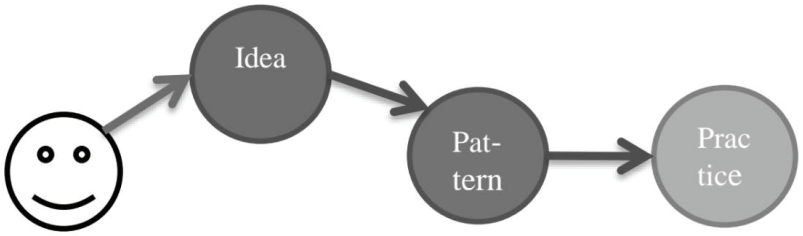
Educational design may be defined as the organization of learning resources and activities to support learners in attaining learning objectives (implicitly or explicitly defined). Educational design is carried out by teachers, course planners, educational developers etc. That is, educational design is not itself research. However, research is undertaken with, for, and on educational design, *e.g.* to develop and test design principles, investigate learning theoretical questions, or test hypotheses on knowing, motivation, collaborative learning etc. Models and metaphors – and modelling and metaphorical thinking – are deployed consciously in educational design, but also play significant roles at a more implicit, unreflected and unacknowledged level, as structuring resources of thinking.

One form of explicit, conscious deployment is constituted by the development, investigation and subsequent utilization of *design patterns* to organize teaching and learning activities in a structured way (Carvalho and Goodyear 2014; Goodyear 2005; Mor et al. 2014). The concept of design patterns was originally developed by Alexander in the context of architecture to deal with recurring problems in a uniform, yet flexible way (Alexander et al. 1977). Design patterns provide a core solution (the pattern) which can be used flexibly in the diverging multitude of situations where the problem is experienced. Within educational design, design patterns constitute models of students' and teachers' activities (design elements), aimed at a particular goal (*e.g.* facilitation of reflection or development of problem solving skills), following learning-theoretically informed principles (design principles) within an overall frame such as a lesson, a test, a lab experiment or study time between lessons. Examples of design patterns are "the interactive lecture" for learner-centered learning (Mor et al. 2014, chap. 1.2.2) and "try once, refine once" for learning through assessment (Mor et al. 2014, chap. 4.2.7). Related to this approach, again involving explicit, conscious use of models, is the development and application of *personas* in the design of courses or educational programmes: A persona is a fictional but realistic character, representative of a group of those users one is designing for, in this case potential participants in the course or programme. Typically, several personas will be developed based on user studies. Between them, the personas should cover the range of different user groups. The advantage of this use of models is that it is much easier for course or programme developers to imagine and take into account learners' (diverging) goals, priorities, attitudes and behavior when they have realistic personalized characters to think from. Potential conflicts between learners may also be foreseen and counteracted in the design.

The development of *design patterns* and *personas* is becoming widespread within educational design. In this sense, this type of modelling is increasingly viewed as a core method within this field (last question above). The scientific adequacy of the method is documented, but is still being researched.

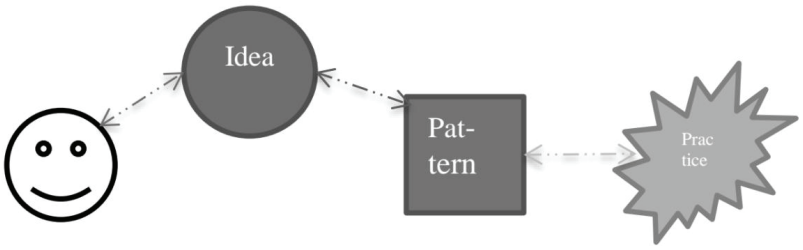
An example of a more implicit use of a model is the understanding – discernable from educationalists' practice – of the implementation process involved in realizing design patterns or "best practice" examples in concrete educational settings. This implicit model is shown in Figure 1. The gist of it is that implementation is a "plug-and-play" process, *i.e.* that there are no essential changes taking place between initial idea, design pattern and actual practice. The initial idea is articulated (becoming clearer but "essentially" staying the same) and then put to use (presupposing predictability of practice "on all essential counts") (Dohn and Hansen 2016).

Figure 1: Implicit Understanding of Design Pattern Implementation Process



However, this is a very simplistic understanding that is not representative of actual implementation processes. There are significant transformational processes involved in articulating an idea and convincing others of its viability (idea → pattern) and likewise in the actual enactment of the pattern in practice (pattern → practice). As argued by Wenger, a design comes into emergent being in the concrete realization which people give it within their specific communities of practices in attunement to and adaptation of already existing routines and participation patterns: "[P]ractice cannot be the result of design, but instead constitutes a response to design" (Wenger 1998, 233). The implementation process is thus more adequately depicted as a "messy", iterative realization process, subject to influence by unforeseen aspects, and therefore not strictly predictable and certainly not linear (Figure 2).

Figure 2: Actual Design Pattern Implementation Process

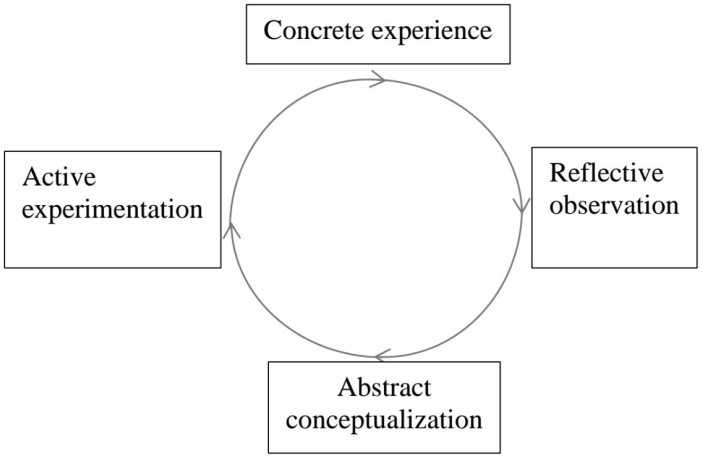


Neglecting the complexities of the implementation process, *i.e.* implicit adherence to the model in Figure 1, is highly problematic, on the verge of being detrimental to learners' learning: It amounts to ignoring the learners' differing uptakes of and approaches to the design pattern as well as the variance in social relationships and interaction patterns across classes/groups of learners. Put bluntly, activities which have been successful in one class may fail totally in other classes.

4. Role of Models and Metaphors in (Conceptualizations) of Teaching and Learning – In Research and Practice

Following design patterns or best practice scripts is one way in which models are put to use within teaching and learning. Conceptualizations of learning and the deployment of these conceptualizations in teaching and learning activities is another. One such example is Kolb's model (Figure 3) of the learning process as a cycle where the learner cognitively moves through processes of concrete experience, reflective observation, abstract conceptualization, and active experimentation – leading again to concrete experience and another spin through the cycle (Kolb 1984).

Figure 3: Kolb's Model of the Learning Process as a Cycle of Cognitive Processes



This model is widely used to argue for the need to engage learners in practical activities beyond reading and writing to allow the experiential and experimental processes to take place. It is also used to structure teaching and learning activities to ensure that learners move through the circle rather than being stuck in one process. A further development of the model is Kolb's claim that learners will have a preference for one (or two) of these learning processes. This leads to a second model with a set of different learning styles consisting of specific combinations of these preferences. Gardner's model of intelligence as comprised of seven different types of intelligence is another example (Gardner 2006), as is the version of learning styles advocated by Dunn and Dunn (1993, 1992). All of these models are put to use within educational practice in the development of teaching and learning activities corresponding to learners' different styles or intelligences–or alternatively, in activities designed to challenge them beyond their preferred style or intelligence. Ideally, this approach has the advantage of customizing learning to each learner, which presumably will heighten their learning outcome. However, there is a clear risk of stigmatizing learners. Likewise, not all disciplines may be learnable through all learning styles/intelligences, just as the competencies required in future jobs may not necessarily match all learning styles or intelligences equally well.

Another example of a model developed in educational research and put to use in educational practice is Hiim and Hippe's relational model intended for pedagogical analysis of learning situations (1993). The model stresses the interrelationship between six elements: student learning outset, framing factors, learning objectives, curricular content, learning process, and evaluation. This model is widely used, at least in the Scandinavian countries, both for analysis

of learning situations and for planning them (though the latter is explicitly advised against by Hiim and Hippe).

At a more implicit level, Sfard has shown that two metaphors of learning guide research on learning, namely the metaphor of acquisition and that of participation (Sfard 1998). I have argued that the same metaphors are also embodied in educational and Web 2.0 practices, respectively, and that problems arise when the latter are introduced as learning activities within the former (Dohn 2009b, 2009a).

As a last example I wish to point to an ongoing research project that I am leading, which is sponsored by the Danish Council for Independent Research, Humanities, Grant No. DFF-4180-00062. The title of the project is *Designing for situated knowledge in a world of change*. The overall project aim is to address the challenge posed by two seemingly opposed factors: On the one hand, the need in today's society for people to move frequently between settings and to put their knowledge learnt in one context to use in others. On the other hand, research findings which show knowledge to be situated, *i.e.* as acquiring form and content from the context in which it is learnt (Schön 1983; Lave 1988; Lave and Wenger 1991; Dreyfus and Dreyfus 1986; Dohn 2011a). These research findings imply that knowledge is not easily transferred from one context to another, but needs transformation and resituation. The project has both a philosophical side, aimed at investigating what is involved in the transformation and resituation of knowledge, and a pedagogical side, aimed at developing concrete designs for learning which facilitate learners in learning to transform and resituate knowledge. Our preliminary findings indicate that it is precisely through metaphorical thinking – and to some extent modelling – that learners succeed in putting knowledge to use in new contexts. Metaphorical thinking is involved in the holistic seeing of new situations "as" known ones whilst flexibly attuning to differences between them. Modelling takes place in the form of structure mapping of traits based on the basic metaphorical postulation of resemblance between the situations.

5. Discussion

Articulating a view such as mine within the context of this HSR Supplement's focus on the role of models and modelling in the Digital Humanities of course raises a number of questions. Willard McCarty has posed particularly succinct ones to me. The questions are not easy and I fear that I shall not be able to provide satisfactory answers to them – certainly not within the space allotted to me; perhaps not at all. A few considerations will have to suffice:

Firstly, given the context of Digital Humanities, Willard McCarty very reasonably asks what is special about computer modelling (as opposed to any other kind). Now, posing the question in this way of course presupposes that

something *is* special about computer modelling – a presupposition which might well be challenged. I certainly acknowledge – indeed I would advocate – that computer modelling (simulations, visualizations, 3D worlds etc.) permits us to have experiences which would be hard or impossible to come by in the physical world alone, for a number of reasons, including historical, geographical, economical, organizational, physical, and skills-related ones. One example is provided by McCarty in his contribution to this volume where he references John Wall's *Virtual Paul's Cross* (Wall 2016), a computer simulation, made by the Virtual St. Paul's Cathedral Project, which allows one to witness John Donne's sermon for Gunpowder Day, Nov. 5th 1622. Another example is avatar embodiment, which allows one physically impossible bodily experiences such as flying or morphing into animal shapes, potentially stimulating reflections on embodiment itself and its role in cognition and learning (Riis 2016). Yet a third is students' use of simulation programs as part of their academic or professional training, *e.g.* programs emulating chemical reactions or organizational developments. Computers may thus stimulate imagination, facilitate reasoning, and provide us with learning situations in novel ways, potentially leading us to insights which we would otherwise be barred from. Nonetheless, I am not convinced that computer modelling is special in principle, neither epistemologically nor ontologically speaking. Like all other models, computer models require a modeler. This modeler may in some instances be a step removed compared to modelers of physical models, in the sense that s/he works to provide a model which may itself develop over time. Still, computer models depend fundamentally on the imagining of the modeler and on his/her understanding of the domain to be modeled – exactly as do physical models. The basic ontological status of the computer model is thus no different from that of the physical model. Neither is its basic epistemological status: Though it may be harder to foresee the specific epistemic affordances for people engaging with the computer model than for physical models, the dependency of their insights on the scope and direction of the modeler's understanding is fundamentally the same as for physical models.

A second question McCarty raised concerns the degree to which reasoning with metaphors and models can be open-ended. Models, he claims, have an analytical focus, are directed to some end, articulated, and spelled out. Furthermore, he claims, both models and metaphors are analogical, and reasoning by way of metaphors and models thus is reasoning analogically, from a relation between two things we know to a presumed relation between corresponding things (A is to B as C is to D). Therefore, it seems, reasoning by way of models and metaphors cannot really be open-ended.

My answer to this question centers on my disagreement with McCarty about the claim that metaphorical thinking is analogical. I follow Lakoff and Johnson in seeing the dependency between analogy and metaphor as going the other way: Metaphorical thinking is primary: it is a holistic seeing-a-whole-field-as-

another-field through the metaphor as "focal point". In this way, metaphorical thinking is in fact open-ended, in that the focal point does not determine the insights to be gleaned by the holistic seeing-as, but sets the outset and domain for them. Analogy builds on the metaphorical, holistic seeing-as, but hones in on certain aspects of the seeing-the-field-as - explicating that "A is to B as C is to D". Thereby it transforms the initial "seeing as" into something more specific, at once enabling and restricting cognition. I agree that modelling is analogical, making it less open-ended than metaphorical reasoning. However, as indicated in my answer to the first question, I do believe that some computer modelling, *e.g.* in the form of 3D simulations, may set the environment for experiences which were not to be foreseen. In this way imagination and insights to be inspired from computer modelling may well be quite open-ended.

A final set of questions from McCarty concerns the ontological implications of my situated view of knowledge. He refers to Donna Haraway (1988), who has argued interestingly about the nature of knowledge as situated, calling at once for a localized embodied epistemology and rejecting both objectivism and relativism. In her words, the essential problem for epistemology and for science

> is how to have *simultaneously* an account of radical historical contingency for all knowledge claims and knowing subjects, a critical practice for recognizing our own 'semiotic technologies' for making meanings, *and* a no-nonsense commitment to faithful accounts of a 'real' world (579, italics in original).

McCarty points out that the revolutionary force of the said "radical historical contingency" have led theorists such as Ingold to shift from "knowledge that" to "knowledge how" and to reconceive the world in terms of skills. But this raises the ontological problem of how to come up with Haraway's "faithful accounts of a 'real' world".

In answering these questions, I should first say that I am sympathetic to Donna Haraway's general epistemological points regarding situated knowledge, which is perhaps not surprising, given that we share inspirational sources in phenomenological philosophy. I definitely agree, on the one hand, that we have to accept the historical contingency of our beliefs, dependent as they are on the way we engage with the world to form them. And on the other hand, this should not lead us into relativism. I consider myself a pragmatist realist, not in the Peircean sense where reality is that on which science converges in claiming the existence of[2], but in a phenomenological sense: With Heidegger and Merleau-Ponty I would say that we are always already in the world which is as it is on the background of our agency in it. The split between subject and object, between cognition and world, is a secondary one, building fundamentally on "taking a step back" from the world we are always already engaged in and interacting with. Speaking ontologically—and with the under-

[2] Peirce (1958).

standing I get from the anthropologist literature that McCarty refers to in his contribution to this volume – it doesn't make sense (as Popper did and others have done after him)[3] to talk of a first world of nature and a second world of culture. The natural world we live in is a cultural one, formed by our cultural interactions with it, and vice versa. Therefore, I find it problematic to speak (as objectivist realists would) of the ontological existence of one world that we epistemologically speaking have different views upon: Our "views" of the world are not static observational views, but are interactional views; *i.e.* we form and are formed by the world in dynamic interaction and our "views" are part of this forming and being formed.

Potentially, we can say, as McCarty does, and as I think Haraway would, too, that different cultures have different "realities", because different cultures engage in (and in reaction, correspondingly are formed by) different interactions. They do so, however, around what Charles Taylor called "human constants" (Taylor 1985) as well as in interaction with natural laws etc. Hence it is not the case that "anything goes", and, though there may be more equally good answers to what the world is like, not any and every answer is equally good (*i.e.* no relativism on my part). For each culture, there are facts of the matter regarding the way the world is structured – and structurable – for them. Providing an explication of these facts of the matter is, I think, providing the "faithful accounts of a 'real' world", based on a world reconceived in terms of skills, which McCarty calls for with Haraway and Ingold.

As a final comment (also upon prompting from McCarty), let me revert again to the overall question of this special issue concerning the role of models in the Digital Humanities by explicating how computer models figure in my pragmatist realism and my understanding of knowledge as situated: As indicated above, on my view computer models may provide ways to simulate new interactions with the world. In this sense, they may indeed provide us with "new worlds" – or at least altered ones. Nonetheless, the novelty and strangeness of these altered worlds will be delimited in their outset by the framing of the modeler's imaginings. The possibility of computer modelling thus does not fundamentally change our ontological and epistemological situation, but it does hold the potential for a number of new specific experiences. Hence, it also holds the potential for us to develop specific forms of situated knowledge not possible in the physical world alone. This situated knowledge will, however, still be the knowledge of embodied beings living in a physical world. No matter how immersed we are in a digital "virtual world", we will still be immersed as physical beings, who *e.g.* sit on chairs, interact with keyboard and mouse, get sore shoulders from cramping up behind the screen, etc. Our apparent "virtual experiences" and "virtual situatedness" will therefore always be those of a real,

[3] *E.g.* Bereiter (Bereiter 1995). Popper argues for his position in (among others) Popper (1972).

embodied person. That is, they will in point of fact be real, embodied experiences, not of virtuality per se, but of interacting in hybrid physical-virtual contexts. And the situated knowledge developed through this interaction will reflect this.

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Modelling What There Is: Ontologising in a Multidimensional World

Willard McCarty *

Abstract: *»Modellieren was ist: Ontologisierung in einer multidimensionalen Welt«*. The incursion of digital computing machinery into the public sphere and the return of "ontology" from philosophical exile occurred almost simultaneously, circa 1948. In this essay I ask, what do the modelling machine and philosophers' irreconcilable accounts of "what there is" have to do with each other? Are the ontological pluralism of the former and the multi-centric multinaturalism of the latter kin? If so, then recent anthropology has much to say to digital humanities.

Keywords: Modelling, ontology, anthropology, multidimensionality, semantic stretch.

> [T]he universe has always appeared to the natural mind as a kind of enigma of which the key must be sought in the shape of some illuminating or power-bringing word or name. That word names the universe's principle, and to possess it is after a fashion to possess the universe itself. "God", "Matter", "Reason", "the Absolute", "Energy", are so many solving names. You can rest when you have them…. But if you follow the pragmatic method, you cannot look on any such word as closing your quest…. [Each word] appears less as a solution… than as a program for more work …. (William James, Pragmatism 1907)

> The worlds in which different societies live are distinct worlds, not merely the same world with different labels attached. (Edward Sapir, The status of linguistics as a science 1929)

> The only way you can catch yourself in the act of reflecting on yourself is by becoming another self – a self which, when it looks down on your reflecting self, will not be included in the reflection. If you want to understand yourself better, you always have to keep on the move. (Jonathan Rée, I See a Voice 1999)

1. A Mid Twentieth Century Co-Occurence

These days, for perfectly obvious reasons, some of us find ourselves telling a Spenglerian *Untergang des Abendlandes*. The evening news confirms that we are all going to hell in a handbasket. But when I look around what I see is an abundance of compelling scholarship in many disciplines, scholarship that

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beckons us to interconnect our own work with it and to connect both to the world we live in. The connections to be made are reciprocal and recursive: we give that others may give back, *do ut des*, again and again in a cycle that changes both.

Here my aim is more modest than such a large project would suggest but still indicative of the benefits. My aim is to suggest – I can do no more than that – some of what might result from growing connections with anthropology and related disciplines. Anthropologists, you may know, have been interested in doing the reverse since at least 1962 (Hymes 1965) and were thinking along similar lines from the early 1940s (Heims 1991, chap. 2). Today both sides have much more to offer each other than was the case then.

My story begins with a curious mid-twentieth century co-occurrence in the Anglo-American world: of the digital computer (which must be told what there is) and of the return from philosophical exile of ontology (the study of what there is – or, as Ian Hacking says (2002, 2), of "whatever we individuate and allow ourselves to talk about").[1] Stumbling on this co-occurrence led me to wonder how the two co-occurrents might be connected beyond computer scientists' adoption of the term in the late 1970s.[2] You may know that thirty years earlier, just as the public was becoming aware of computers, philosopher Willard Van Orman Quine began giving serious attention not just to ontology but to ontologies in the plural.[3] (In Germany the co-occurrence happened earlier, with Martin Heidegger's *Sein und Zeit* in 1927 and Konrad Zuse's Z-series machines from ca. 1935, a year before Turing's foundational paper.[4]) I asked myself, what might there be in these co-occurrences to help us explain them? But then I noticed something else: the rather dramatic and fruitful career, seeded by Quine, that ontology has taken in theoretical anthropology and related disciplines for the last few decades. So my question became also this: what

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[1] A convenient date for the first public exhibition of a large-scale digital computer is the launch of the Selective Sequence Electronic Calculator (SSEC) at IBM World Headquarters (New York) in 1948, visible from street-level until 1952 (McCarty 2011, viii). For ontology see note 3.

[2] For early examples see Kosslyn 1978 (drawing *inter* alia on Goodman 1968) and McCarthy 1980, Alexander et al 1986. Formal definition came with Gruber 1995. See also Gruber 2009, Sowa 2000 (51-131) and Zúñiga 2001. For related activities in Natural Language Processing see e.g. Margaret Masterman's work in the 1950s and 1960s (Priss and Old 2009; Sowa 2010 [245-50]); for database design see Sølvberg 1979; Ramsay 2004 (195).

[3] See Quine 1948, (1953) 1961 (his note on "Identity, ostension, and hypothesis", p. 169, in particular), (1960) 2013 and 1969. For the status of ontology at the time see Feibleman 1949.

[4] At the very beginning of *Sein und Zeit* ([1927] 2001, §3) Heidegger makes a distinction between ontological (Being as such) and ontic (regional or specific Being, i.e. delimited and implicitly temporal, as studied in the sciences); see Steiner 1978 (79-80). For Zuse's development of his stored-program computer see Zuse (1993) 2007 (chap. 3). Heidegger's work became known in Anglophone computer science with Dreyfus 1972 and important in that discipline thanks to Winograd and Flores 1987.

might we learn about the creative potential of digital machines from the scholars of human historical and contemporary alterity?

Nothing in the literature suggests that computer scientists took much notice of philosophy when they started talking about ontology. Perhaps they thought they didn't need to, since ontology is obviously fundamental to computing machinery: after all, to do any useful work the machine must be given a model of what there is (Smith 1985). But the complexity of the world and limitations of time constrain any implementable ontology to be a version of the domain to which it applies, that is, to be an ontology, one of many. Hence the implicit, more specific and possibly important connection between the digital machine and both Quine's and Heidegger's pluralisation.

2. The Popularity of "Model", Many Ontologies and Cosmological Change

To get further with this, let me take a different tack. When we think about models carefully, as Nelson Goodman did in *Languages of Art* (1968), we can become quite annoyed, as he did, at the ungovernable, viral appeal of the word "model". For us its sloppy use makes its specifically computational sense difficult to pick out; in consequence, we are apt to miss what is genuinely new and so have no convincing answer other than "more, faster" to rightfully skeptical colleagues. But its popularity is an inescapable fact, I realised. So I started to ask, *why* is it so popular? Was the invention of the digital machine a like response, as the coordinated surge of word and thing would suggest? [Figure 1]. Might the same be true for "ontology"? What can we learn from that? What are they responses to? Answers aren't as obvious as may seem: Plato's *Symposium* teaches that we tend to go for what is achingly present in its absence, and so want, and thus desire. Rather than go for a quick dismissal by reference to technological determinism, *pure* coincidence or the fog of a *Zeitgeist*, I wondered if we might be able to identify a Foucauldian "historical *a priori*"[5] – or, to paraphrase Jonathan Rée, that metaphysical notion which, in the middle of the last century, infiltrated ordinary common sense and became a real force in the world (1999, 382).

Consider, for example, Quine's argument that translation is inevitably indeterminate 2013 [1960] chap. 2), from which he concludes that we can do no better than many incompatible stock-takings of the world's goods. Put that next to Quine's friend and reader Thomas Kuhn's argument two years later in *The*

[5] The phrase is from Georges Canguilhem's review of his former student Michel Foucault's *Les mots et le choses* (1966) in Canguilhem 2005/1967, 90; quoted and discussed in Hacking 2002, 5.

Structure of Scientific Revolutions (2012 [1962]) for the inevitability of successive, incompatible, indeed incommensurable paradigms. Consider also my favourite example of a clarion-call within digital humanities: the American literary critic Louis Milic's short article, published four years after *Structure*, in which he wrote that, "We are still not thinking of the computer as anything but a myriad of clerks or assistants in one convenient console" (and I would go so far as to say "a myriad of *servants*", since for us their far quicker, less intrusive and better service is so discrete as to be all but invisible). "The true nature of the machine is unknown to us…", he went on to say (and I would add, unknown because this "nature" is not natural, not a given, but an emergent recursive co-creation of human and machine). Milic saw, as he said, that "Its intelligence and ours must be made complementary….", and so implied the crucial beyond-the-Turing-Test question of what we take intelligence to be. He went on: "Thinking in a new way is not an easy accomplishment. It means", he said, "*reorientation of all the coordinates of our existence*" (1966, 4-5, my emphasis). It means, in other words, a cosmological reconfiguration. He called his brief article, "The next step". It was, I like to point out, the first article in the first issue of the first journal in digital humanities. I don't think we've taken that step yet.

3. The "Ontological Turn" in Anthropology

I intended no causal implications when I said that Quine seeded later developments in anthropology, though his thought-seed did germinate there. What he actually did, on record, was to draw an analogy between the ontologising philosopher and a fictional anthropological linguist attempting to translate an imagined native's exclamation at the sight of a rabbit (2013 [1960], 25ff.). Such was and is the field anthropologist's dilemma, the core scenario to which some anthropologists have responded by making what has been called "the ontological turn", away from the epistemological angst Quine depicted to something rather new.[6] Commenting on Eduardo Kohn's *How Forests Think: Toward an Anthropology beyond the Human* (2013), for example, Philippe Descola refers to

> [the] general predicament that some of us… find ourselves enmeshed in. To put it simply, the project of repopulating the social sciences with nonhuman beings, and thus of shifting the focus… toward the interactions of humans with (and between) animals, plants, physical processes, artifacts, images, and other forms of beings… (2014)

[6] Increasingly noisy since Henare, Holbraad and Wastell identified "a quiet revolution" and applied the term "ontological turn" to it (2007, 1, 7).

Modelling (we might say) everywhere, of everything, by every being with agency.

The arguments quickly become complex, intricate, difficult. I can only present a sliver. Almira Salmond's helpful overview in the journal *Hau* sorts the enthusiastic confusion this turn has become into "three ethnographic strategies for addressing ontological alterity" (2014): Tim Ingold's, Descola's and the one she favours, which for want of space is my sole focus here. She calls it "recursive" because it draws recursively, transformatively on "the imaginative powers of the… peoples and collectives" whom anthropology proposes to explain.[7] Its leading proponent, Eduardo Viveiros de Castro, defines it in stark contrast to what he calls "our modern cosmological vulgate": the multiculturalist supposition of "a single world or nature… around which different partial cultural views orbit" (2010, 329). This vulgate sounds pleasingly liberal and democratic. Look closely, he argues, and the single world it supposes turns out to be our world universalised. In other words, take a step back and this world begins to look very much like Michel Foucault's invocation of Jeremy Bentham's panopticon.[8] In the late eighteenth century Bentham designed a cylindrical prison with a central watch-tower from which all inmates could be secretly observed. Because no inmate could know when he was being watched, the panopticon induced "the sentiment of an invisible omniscience"[9] – a crippling, economical god's-eye view. Hence the predicament of those entrapped by their very visibility, as Foucault has said, and thus Viveiros de Castro's metaphor for the colonising grip of that panoptic cosmological vulgate.

4. The Multidimensionality of the Real and Our "Next Step"

Ontology had to change before the turn in anthropology could be made, from elaboration of a "great chain of being" to a probing which reveals multiple ontologies.[10] The modelling machine, working through many disciplines, has undoubtedly been an influential part of this change, so also the viral spread of the term "model". Remarkably, throughout the panic of relativism in the "science wars",[11] modelling and the many ontologies it makes operational have diversified not destroyed the idea of the real. The anthropologists I have quoted

[7] Viveiros de Castro 2014 [2009], 40.

[8] Foucault, "Panopticism", in Foucault 1995 [1975], 195-228; plate 3 shows Bentham's design). See Bentham1995.

[9] A widely quoted phrase, not in Bentham's works, often attributed to an anonymous architect. See Nugent 2011; Lyon 2006.

[10] Lovejoy 2001 [1936]; see also Lovejoy 1909.

[11] Hacking 1999; Geertz 1984.

have responded by taking "the enemy's point of view" seriously – Viveiros de Castro's phrase 1992 [1986] – as a recursive instrument of disciplinary self-redefinition. Such recursion is no stranger to modelling. Ancient historian and anthropological fellow-traveller G. E. R. Lloyd has used his half-century of meticulous comparative analyses of ancient Greek and Chinese thought to draw out the "multidimensionality" of the real and to show the "semantic stretch" it requires of us.[12] We might call this the agile modelling of an endlessly faceted world. Thirty-five years ago Ian Hacking, in *Representing and Intervening* (1983), argued cogently that new things become real by means of manipulatory experimental modelling. In his essay "Historical Ontology", he has asked, echoing Foucault: "if we are concerned with the coming into being of the very possibility of some objects, what is that if not historical?" What does such reasoning lead to if not specific, local ontologies, "molded in time"?[13]

What is to be done with these anthropological, historical and philosophical inflections of modelling gone viral – with the possibilities they suggest and the demanding help they offer for growing nascent digital humanities into one of the *literae humaniores*? That's the question I struggle with. Half a century on from Louis Milic's "The Next Step" I wonder what we can say his cosmological reconfiguration would entail if we took it seriously by taking on the anthropologists' challenge. To use Clifford Geertz's terms, it would mean something far beyond the mimetic "modelling *of*" real-world data, beyond also "modelling *for*" objects that begin as more or less definite ideas and aim at concrete realisation.[14] Both of these will, of course, remain valuable things to do. But they are hardly sufficient for a computing *of* as well as *in* the interpretative disciplines. (Let us be done with the crippling fright of the technoscience which makes our beloved machine possible and with the equally damaging ignorance of social thought, and so call these disciplines the *human sciences*.)

What I think taking Milic's next step might lead to most immediately is a concerted, experimental, hardware-actualised enquiry into what we mean by "intelligence", by "reason", by "cognition" – recursively involving *the machine's point of view with our own as both develop in interaction with each other*. This is not the already well developed programme to demonstrate that cognition is computational, rather to find out through a back-and-forth conversation *what it is*.[15] It would mean enquiring into the machine's cosmology, as it is now, as it could become. This enquiry would mean, to paraphrase Viveiros

[12] Lloyd 2015, 5. See Inwood and McCarty 2010, contributions to which embrace all three of Salmond's ethnographic approaches to ontology. For a summary of Lloyd's work, <https://en.wikipedia.org/wiki/G._E._R._Lloyd> (Accessed December 19, 2016).

[13] Hacking 2002, 2, 4; Foucault 1984. See also Lovejoy 1909.

[14] For a discussion see McCarty 2013 [2005], 24; referring to Geertz 1993 [1973], 93.

[15] Yes, some of this goes on in the cognitive sciences, but we in the humanities have not included ourselves, nor have these sciences looked often to the humanities for more than window-dressing.

de Castro, treating ideas indigenous to digital hardware as concepts to think with, then following the consequences, defining the range of possibilities these concepts presuppose, the conceptual persona they make possible, the reality they delimit (2014, 187). This is in no way to disrespect the Amazonians and the others from whom Viveiros de Castro and colleagues have learned so much. It is, rather, to ask if we can learn from these anthropologists in turn what it means to pull oneself away from the narcissistic self-entrapment that Joseph Weizenbaum discovered in the mid-1960s when users of his conversational program *Eliza* mistook it for their confessor.[16] It is to ask whether the ontological turn in the anthropological sense has taken hold in digital humanities.

Is it not nascent in what the scholar-programmer already does, most when designing, building and refining simulations? Elsewhere I have argued that the great lesson to be learned from simulation – which is modelling turned loose to go where it can – is that it shows computing to be just such a producer of fiction: an instrument not so much for nailing down facts (although it can do that) but for imagining them, acting them out, solidifying them, in some cases giving us a new (tentative) reality to probe (McCarty 2018). I know of no better example of this than John Wall's simulation of John Donne's Gunpowder Day sermon in 1622 as it might have been delivered from the long-vanished Paul's Cross preaching station adjacent to the medieval St Paul's, which the Great Fire of London destroyed in 1666. With his *Virtual Paul's Cross* Wall explores "what we are doing when we believe we have discovered, from our experience with a digital environment, things about past events that are not documented by traditional sources" (2016,283). That's a cliff-edge, inviting flight, a fiction (to paraphrase Viveiros de Castro) that is historiographical, but historiography that is not fictional: a digital machine's perspective on the sermon preached on a semi-fictional occasion by a semi-fictional John Donne from a semi-fictional Paul's Cross in a semi-fictional space to a semi-fictional crowd. Ironically we have very good reason to think that it is a better, more truthful fiction than we get by pretending that Donne's published words, which he wrote down sometime later from the notes he used while preaching, are the real sermon.

In 1962 Cambridge linguist Margaret Masterman proposed that the computer could become a "telescope of the mind", changing, as the early telescope did, our whole conception of the world (1962, 38-9). Some toss this off. But is the instrument as unproblematic as her metaphor seems to imply? To echo Hacking (1983, 186-209), do we *see* through, or see *through*, a telescope? Today (just as in microscopy) optoelectronics interpose a hermeneutic black-box between the eye and its object, complicating – but not essentially altering –

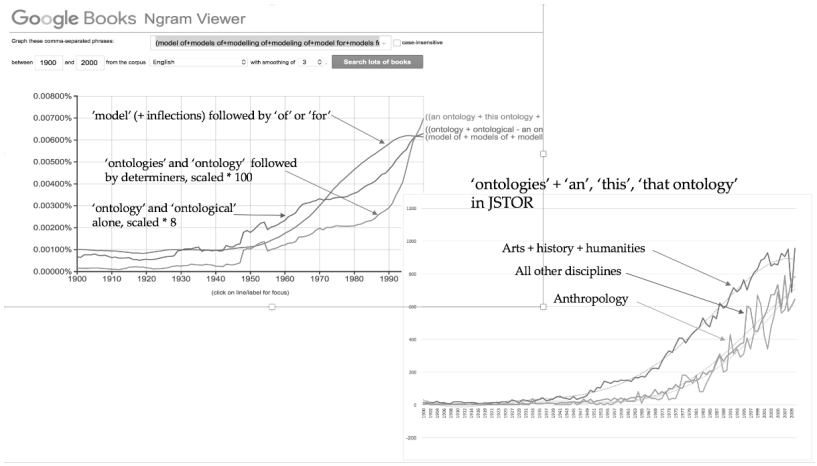
[16] See esp. the introduction to Weizenbaum 1976. Note that according to its author, *Cannibal Metaphysics* is a commentary on an unwritten, fictional book entitled *Anti-Narcissus: Anthropology as a Minor Science* (Viveiros de Castro 2014 [2009], 39).

the philosopher's question. For when Galileo looked through his *occhialino* much of what he saw had been seen before, but the differences were enough to make "what was" "momentarily mutable", stuff of the eye reshaped by his mind into "a compelling argument for Copernicanism".[17]

Disciplines, I like to say, are not places of arrival, clubs to be joined, identities to assume or platforms of visibility, but starting-points. So the question is: where from here? There are many maps.

5. Figure

Figure 1



[17] Thanks to Crystal Hall (Bowdoin) for the commentary on Galileo, in private e-mail, 6/1/17. The literature is extensive; see esp. Lipking 2014; Biagioli 2006, chap. 2.

6. Discussion

NBD: Nina Bonderup Dorn
RB: Rens Bod
GO: Gunnar Olsson
FJ: Fotis Jannidis
WM: Willard McCarty

In her dedicated response NBD singled out the alterity of worlds, especially its connection with the concept of situated knowledge in her own paper. She questioned the implications of "ontological turn", asking whether the change is not so much a rejection of epistemological concerns but a product of them and a shift of emphasis. WM agreed, noting the meandering of "turns", now this way, now that, common in academic disciplines, each turn attempting to correct for prior deficiencies. NBD wanted to know what is "the machine's point of view"? WM responded by referring to the mediation enforced by the absolute consistency and complete explicitness of the digital medium and to the combinatorial negotiation implicit in modelling. He argued again for the crucial importance of binary logic on the one hand and imaginative play against that foil on the other.

RB noted that the fictionalizing trajectory of computational simulation, as in the example of the *Virtual Paul's Cross*, is not yet accepted in the humanities. WM pointed to the mistaken belief that the computer is a fact-and-proof machine, a "knowledge-jukebox", and advocated strong emphasis on the machine as an instrument of the imagination. RB mentioned the corrosive effects of simulation on mind/body dualism.

GO, following up on NBD's point about the "ontological turn", offered the arresting counter-metaphor of epistemological and ontological concerns as diachronic intertwined strands, each dependent on the other.

FJ, finally, asked what possibly we can mean by using such words as "intelligence" and "perspective" when talking about machines. He asked if such talk is guilty of a category error. WM thought that the development and adoption of digital machinery was eroding such categorical distinctions, that drawing such lines has a long history of being redrawn to save outmoded ideas of the human. He may have quoted Evelyn Fox Keller, to the effect that asking if a product of computational biology is alive is beginning to look like an historical rather than a philosophical question. And he may have added that "intelligence" no longer looks like a single benchmark.

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